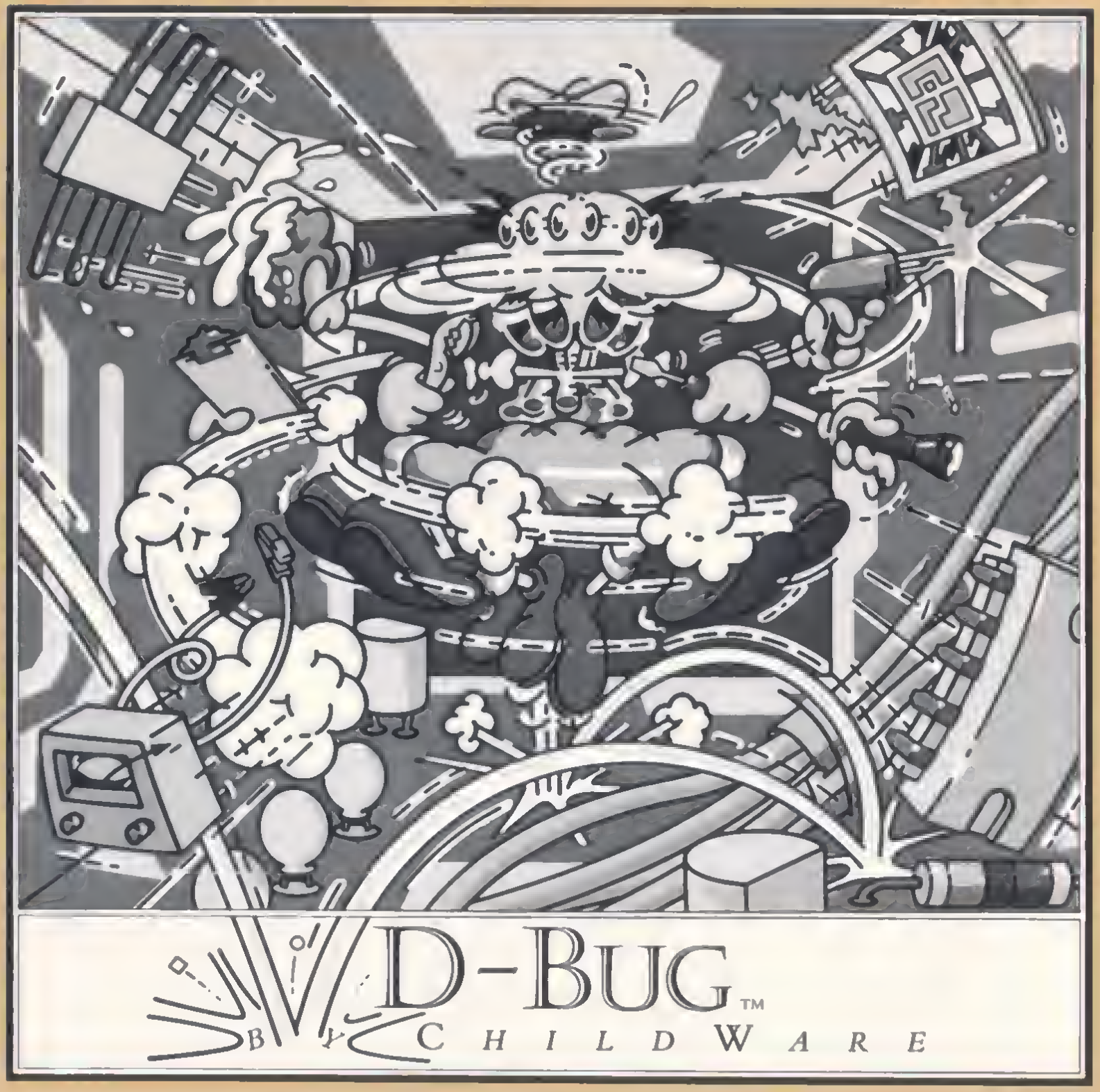
# THE MANUAL



## NOTICE



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MANUAL DESIGN BY WILLIAM GIN.

# D-Bug™

**A Video Game and a "Fantastic Voyage" Down Inside the Computer that Runs It**

D-Bug is a game within a game in a computer within a computer. It works like this:

1. There's your own home computer, the one you'll put your D-Bug disk in. (For loading instructions, see the Command Summary card that came behind the disk.)

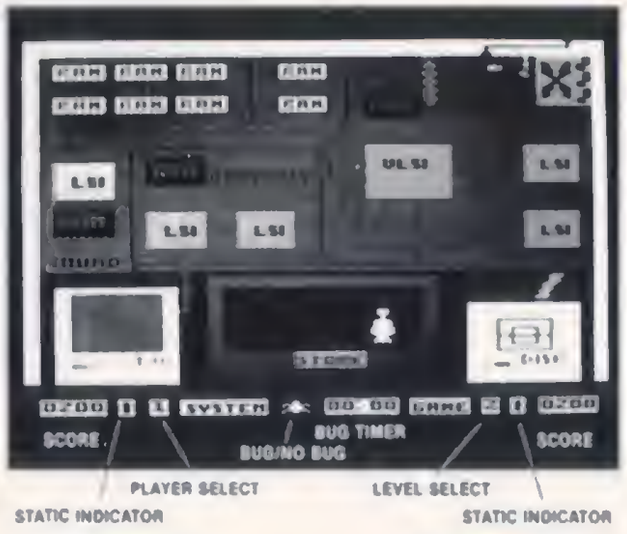
2. There's the D-Bug computer that shows up on the screen whenever you "boot" (that means "start-up") your D-Bug disk. Watch as Charlie Fixit turns on the D-Bug computer and the system comes to life.

3. When Charlie finishes, the D-Bug computer will be ready to play a capture game called Gotcha! You can play Gotcha! alone against the computer, or it will keep score and be the referee while you and a friend compete with each other. To learn how to play the game and use the D-Bug controls, look on pages 2 and 3.

4. The game within a game happens when the D-Bug computer breaks down and the Gotcha! game won't work anymore. You must then go down inside the D-Bug computer in order to fix the "bug" that's causing the problem. Pages 4 and 5 show how to fix one of the things that can go wrong, and you can use **Charlie Fixit's Reference Manual** (pages 8-13) for help with the rest.

For Your Information: Know why they call fixing a computer "debugging?" The legend is that when computers were still very new – back in the late 1940's – a mysterious computer failure turned out to be caused by an honest-to-goodness bug which had somehow crawled or flown into the machine. And ever since then, "bug" is the name computer users have given to any computer problem they can't fix until they've tracked down the hidden cause.

## GETTING STARTED




PLAYER 1 PLAYER 2

Whenever you boot your D-Bug disk, Charlie will turn on each of the system parts. When he's finished, the screen will look like the one pictured above with the Player Select control highlighted. Moving your joystick up and down changes between the one and two player settings. Pressing the joystick button causes three characters to march through the window of Charlie Fixit's Store. Their names are Moe Dem, Dot Matrix and M.A.X. the Robot (the initials stand for Mechanized Antibug eXpert).

When you see the character you want to be, press your joystick button. (If two are playing, player 1 chooses first. The computer always plays the role of Charlie Fixit.) When everyone has selected a player, the highlight will move to the word GAME. To begin playing the Gotcha! game (described on the next page), just press your joystick button.

If you'd like to take a little tour of the D-Bug computer system (and get a taste of what you'll do when the D-Bug computer breaks down) before you start playing Gotcha!, move your joystick sideways until the word SYSTEM is highlighted, then press your joystick button. Your character will appear and you can use your joystick to move it around on the system screen.

If you press your joystick button again while standing over a particular section of the system, you'll enter that section and it will fill the screen. Moving your character back down into the control panel will cause your character to disappear and will return the system overview to the screen with the word SYSTEM highlighted again in the control panel. To take an up-close look at the other system sections, just follow the same steps for each one.

You can also use your joystick to move the highlight over the other controls, and once there you can change the settings by moving the joystick backwards and forwards. At first, it's a good idea not to change the settings, even if you're playing with a friend. That way both of you can learn some things about debugging by watching Charlie do it whenever a bug shows up during the computer's turn. Later you can use the Level Select to start immediately at a higher level or the Bug Timer to give yourself more or less time to track down each bug – it's up to you. You can even use the Bug/No Bug control to play Gotcha! without being interrupted by bugs. (Changes in Level Select take effect immediately. Changes in Bug Timer and Bug/No Bug take effect at the beginning of the next turn. Changes in Player Select always start the whole game over from the beginning.)

The goal in Gotcha! is to see that more of your shapes get captured than those of your opponent. Selecting GAME in the control panel and pressing your joystick button enters the game of Gotcha!

## The Rules

1. Player one tries to capture butterflies, the other sailboats. (To change these shapes, see the Graphics section of Charlie Fixit's Reference Manual – page 13. You can also change sounds. See the sound section, page 12.)

2. When it's your turn, your Score Box will flash. If you get the first move in the game, the computer will begin the game by making the first move for you. For all other moves, use your joystick to place the capture marker over any uncaptured piece it's touching (diagonally, as well as horizontally and vertically) and press the button.

3. Every time one of your pieces is captured, 10 points are added to your score, no matter who captured it – you or your opponent. (Both players start with 200 points.)

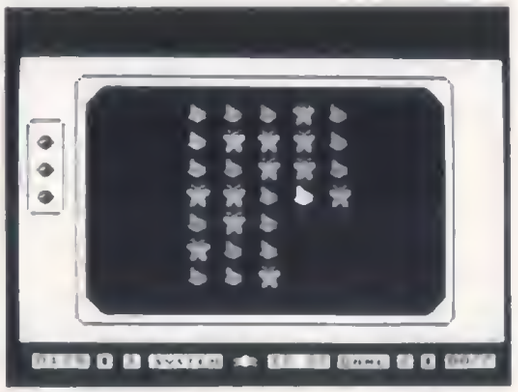
4. When neither player can move, the game is over. The player with the most captured pieces gets a 50 point bonus and a new Gotcha! game starts.

**Strategy Tips** – Try to manuever your opponent into a position where he, she or it has to capture one of your pieces in order to move. Also, make moves to seal off some of your opponent's pieces so they can never be captured.

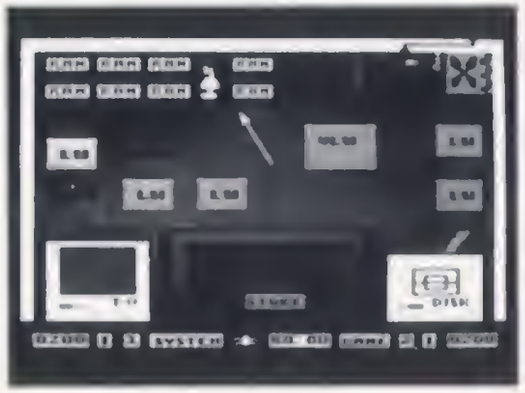
While you play Gotcha!, the suspense will grow, and grow, and grow, until SUDDENLY, a bug appears somewhere in your D-Bug computer. When that happens the screen will give a warning flash, a bug symptom will show up on the Gotcha! screen, and the System light will turn on in the Control Panel. You won't be able to finish playing your Gotcha! game until you've gone down into the D-Bug computer and found and fixed that bug. To find out how to do that, turn the page and read on. (Remember, if you just want to play Gotcha! without having to fix any bugs, change the Bug/No Bug control setting before you start playing.)

## DEBUGGING THE D-BUG COMPUTER

When a bug appears in your D-Bug computer, you must enter the system, track down the bug and fix it. In the example pictured here, the problem is a hot RAM chip in the display portion of the Memory section.



1. When a symptom shows up on the screen and the SYSTEM light turns on, study the symptom for clues about where to look for the problem. (In levels 1 and 2 you get a hint. The display will alternate between the Gotcha! screen showing the symptom and the system screen with the bugged area flashing on and off. Turn to the part of Charlie Fixit's Reference Manual that describes the bugged section to read about the parts there and the symptoms associated with each one. Once you've become familiar with the material in Charlie's Manual, you won't need the hint and you can play at the higher levels.)



2. Since the symptom screen shows part of the display missing as though the computer has "forgotten" what to put there, the Memory section seems a likely place to look for the trouble. Press your joystick button, then move your character up to the Memory area. (In level 1, you'll receive an additional hint: if you've found the right area, your character will flicker over that section.) Enter the Memory section by pressing your joystick button so you can pinpoint the bug and fix it.


3. Once inside the Memory section, look for the bug by moving your character over each component part, watching for a tell-tale flicker. (If you read the part about the Memory section in Charlie's Manual, you know that there are 6 RAM chips there devoted to the display.) A red flicker means the part's hot and must be replaced, and that calls for a trip to Charlie's store. (See the Debugging Tips on page 6 for information about what to do if there's a gray flicker or no flicker at all.)


4. When you move your character down on top of the store, it will "stick" there. Moving the joystick from side to side will then cause different parts to scroll through the store window. Pressing your joystick button buys the part in the center of the window and pops your character loose so you can move it around again. Moving your joystick forward without pressing the button lets you leave without buying anything. If you do buy, Charlie will automatically deduct the price of the part from your score. (See Charlie Fixit's Reference Manual, page 8, for a list of parts and their prices.)


5. After you've bought the replacement part you need, move back up to the buggy part and press your joystick button. The buggy part will disappear, and the part you bought will appear in its place. Then move into the control panel and turn on the GAME light. To return to the Gotcha! game now that the computer's been fixed, press your joystick button. (Be careful! If you try to put in the wrong part, it will blow and you'll have to go back to the store again.)

## WATCH OUT FOR TRANSIENTS!

Sometimes the electric power supplied by your pawer company can suddenly and briefly become much stronger or weaker than normal (perhaps causing your lights to flicker or your radio to give out a burst of static noise). These pawer surges are known as "transients" (because they last only a short time). They can cause harmful buildups of static electricity inside computers.

In D-Bug, transients look like pulsing "fireballs". They appear from time to time and chase your character. If they catch you, they cause you to become charged with static electricity, a fact that will be reflected in your Static Indicator. If you get caught often enough for your Indicator to fill up, it will start to flash – a warning sign that you're likely to "blow" any chip you touch. To get rid of static charge build-up, enter the Power Supply area, touch the Ground symbol and press the joystick button. (See page 9 in Charlie Fixit's Reference Manual.)

Note: After you've successfully fixed a number of bugs at one level, you'll automatically graduate to the next one.

**1. Symptom Hints** – In levels 1 and 2, the symptom display will alternate between the Gotcha! screen showing a symptom and the system screen with the bugged area flashing. Use this hint to learn which symptoms are associated with failures in particular areas. And use Charlie Fixit's Reference Manual to learn which parts in each area go with each symptom. When you think you've learned enough to try the game without the hint, go on to level 3. And then when you're a fast enough debugger to handle more than one bug at a time (without the system hint, of course), go on to level 4.

**2. Flashing Characters** – When you think you've identified the problem area, enter it (by pressing your joystick button while your character's on top of the area) and begin moving your character over each part. A gray flicker over a part means the part's loose. To fix a loose part, stand on top of it with your character and press your joystick button to jump up and down and push the part back into place. Red flickers mean hot parts. Hot parts must be replaced with new ones from the store. (See page 5, picture 4 if you've forgotten how to buy parts from the store. See page 8 for part prices.) Be careful. If you try to put in the wrong replacement part, the part will burn out ("blow" and "fry" are two colorful ways engineers describe this). The store gives no refunds for fried parts.

**Note: Extra Hint for Beginners, Extra Challenge for Experts** – In level 1, you also get flickers on the system screen over the bugged area – an extra hint to help you learn your way to confident debugging. At level 5, you no longer get red and gray flickers even in individual sections – a challenge to see how fast you can find loose and hot parts from symptoms alone.

**3. The Tester** – If you don't get any flickering at all, but you're pretty sure you're looking in the right area, the problem may be the result of a chip that's gone bad. To check for bad chips, go to the store and "rent" the tester (works just like buying parts), then tour the suspect section again. If there's a bad chip in there, your character will flash black when you pass over it. If you read and master Charlie's manual, you'll be able to use your knowledge of symptoms and causes to save testing time – an important skill since the tester costs more the longer you use it. The tester works at all levels.

**4. Cables** – Don't forget to check for loose TV monitor and disk drive cables or a loose disk drive door on the system screen. You'll get a gray flicker if you find one and should fix it like any other loose part.

bugs.

**5. Time is money** – It's true in D-Bug. When something goes wrong with the D-Bug computer during your turn, you begin losing points at a steady rate until you fix it. If you run out of time on the Bug Timer before you fix the bug, your opponent (either human or computer) gets a chance to find and fix it. If he runs out of time, you get another chance unless you're out of points. If you both run out of points, the game ends and you go back to the beginning with a fresh round of Gotcha! (If you find that you **never** have enough time, enter the Control Panel, turn on the Bug Timer and push your joystick forward to increase the amount of time you get for debugging. If you want to shorten the time to create a more difficult challenge, pull back on the joystick.)

**6. Charlie** – If you give up on the bug but don't want your opponent to get the chance to find and fix it, you can hire Charlie to fix it for you – provided you have enough points (it'll cost you 100 – Charlie's time is most expensive of all). To hire Charlie, "buy" his toolbox from the store. (Remember, if you play against the computer, it gets to use Charlie for free.)

**7. Good Habits** – Make yourself a troubleshooting chart listing symptoms in the first column, causes in the second column, and an indication of how many times you've seen that symptom with that cause in the third column. That will help you learn at first; later it will prove a very valuable resource for playing at levels 4 and 5.

## Fixit Reminders

Gray flickers mean a loose chip, fuse or cable; place your character over the part and push the joystick button to jump on the loose part and push it back in place.

Red flickers mean a hot chip or area. Buy a new chip from the store and replace the hot one with it. If the red flicker shows up in the Power Supply, press your joystick button over the filter to clean it.

Black flickers (which show up only when you use the Tester, or on the system screen in level 1) mean a bad chip or fuse. Buy a new chip or fuse from the store and replace the bad one with it.

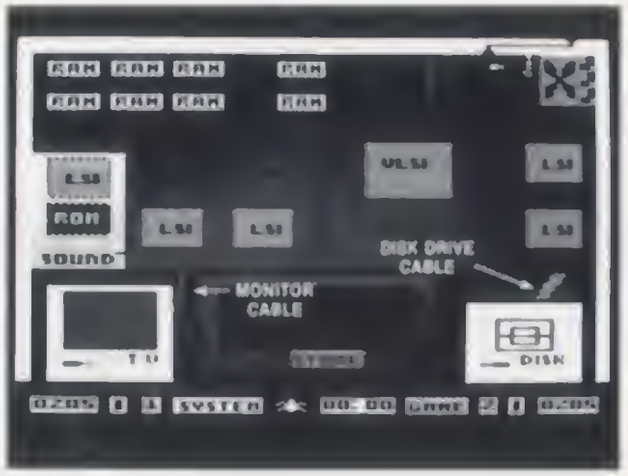
To fix Boot Errors, check the disk drive cable and door first. If there's no problem there, go into the I/O section and check out the LSI chips. If all else fails, buy a new diskette from the store and put it in the drive.

## Parts/Price List

| | |
|---|---|
| Fuse | 1 point |
| RAM chip | 5 points |
| LSI chip | 10 paints |
| ROM chip | 15 points |
| VLSI chip | 20 points |
| Diskette | 35 points |
| Tester | 5 points per Bug Timer unit |
| Charlie's "House Calls" | 100 points, flat fee including both parts and labor |

## Manual Table of Contents

## DISK DRIVE AND TV MONITOR




A cable connects the I/O section to the disk drive. Another cable connects The TV monitor to the computer. If the monitor cable comes loose, "snow" will flicker on and off the screen. If the disk drive cable comes loose, a boot error will result. A loose disk drive door can also cause a boot error, and so can a bad Gotcha! program disk. These problems must be fixed on the system screen.

## POWER SUPPLY

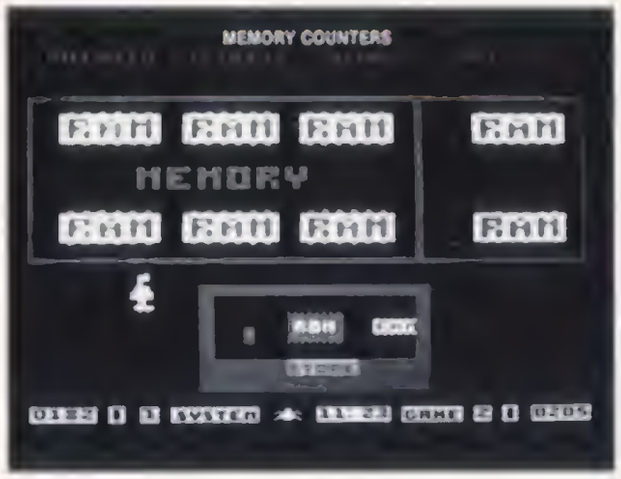

The Ground Symbol – represents the means used to harmlessly discharge potentially harmful build-ups of static electricity. When your Static Indicator is flashing, touch this symbol and press your joystick button to discharge the static so you won't blow the chips you touch.

The Fuse – prevents the power supply from damaging the rest of the computer system. If there is too much power, the fuse will fail and "snow" will appear on the screen because the D-Bug computer is not sending a signal to the TV monitor. Power will be restored when the fuse is replaced. If the fuse comes loose, the "snow" display will flicker on and off.

The Fan and Filter – The fan blows air around the system to keep the computer from overheating. The filter catches dust that could otherwise cause damage. If the filter becomes clogged, there will not be enough fresh cool air coming into the system and the computer will begin to overheat. Anything can go wrong when this happens. To clean the filter, place your character over it and press your joystick button.

The On/Off Switch – Charlie flips this to turn the computer on when the game begins.

## MEMORY




The Memory section at the top left of the D-Bug system is divided into two parts. The first six RAM chips store graphic displays you will see on your screen. If one of them comes loose, 1/6 of the screen display (corresponding to the loose chip) will flicker on and off. If one gets hot or goes bad, a portion of the screen will go off and stay off.

The last two RAM chips hold the Gotcha! program. If the top one comes loose, garbage will flicker on and off. If it goes bad, dynamic garbage will come on and stay on. A loose one on the bottom will cause the display to flicker back and forth between good Gotcha! shapes and incomplete ones. If it's hot or bad, the incomplete shapes will come on and stay on.

## CPU (Central Processing Unit)


VLSI Chip – This is the microprocessor, the "brain" of the computer. If it gets loose, anything can go wrong. If it's hot or bad, dynamic garbage will appear on the screen.

The ROM chip in the CPU contains the "boot" program. This gets things up and running when Charlie first turns the computer on. If it gets loose or hot or goes bad, you'll get nothing on your display since the D-Bug computer can't even get started.

## Chart A — Decimal/Binary Number System

| Decimal | | | | Binary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100's | 10's | 1's | 128's | 64's | 32's | 16's | 8's | 4's | 2's | 1's | |
| 16 = | | 1 | 6 | | | | 1 | 0 | 0 | 0 | 0 | = 1000 |
| 75 = | | 7 | 5 | | 1 | 0 | 0 | 1 | 0 | 1 | 1 | = 1001011 |
| 189 = | 1 | 8 | 9 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | = 10111101 |
| 255 = | 2 | 5 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | = 11111111 |

Underneath the magic of what computers can do lies the happy intersection of three facts: 1's and 0's can be made to stand for any number; on and off can be made to stand for 1 and 0; on and off can also be translated into, "True or false?"

The registers at the top of the Memory Section are included to help you think about the first of those facts. Watch the right-to-left pattern as the numbers change. Each of the four eight digit numbers is increasing in size according to the rules of a number system (called binary) that only has 2 numerals – 0 and 1 – instead of the 10 numeral system you use (called decimal).

To write numbers bigger than 1 in the binary system, you do what you do to write numbers bigger than 9 in the decimal system you usually use. You make position count for something. In the familiar decimal system, each position is worth 10 times as much as the one immediately to its right. In the binary system the computer uses, each position is worth twice as much as the one on its right. Chart A spells this out.

## Chart B — Logic Gate Truth Table
**(1 = T = TRUE, 0 = F = FALSE)**

| Electricity is on | | Electricity will be out at the output of | | | | |
|---|---|---|---|---|---|---|
| INPUT A | INPUT B | AND GATE | OR GATE | EXCLUSIVE OR GATE | NAND GATE | NOT GATE |
| T | T | T | T | F | F | - |
| T | F | F | T | T | T | - |
| F | T | F | T | T | T | - |
| F | F | F | F | F | T | - |
| T | - | - | - | - | - | F |
| F | - | - | - | - | - | T |

True and false come into play with what computer designers call logic gates, examples of which are pictured in the CPU section. Gates are like traffic cops. They let electricity flow through if certain things are true and don't if they're not.

Watch the pattern of the 1's and 0's associated with each gate. Imagine electricity coming in from the right, traveling to the left. A 1 (one) means "it is true that electricity is on here." A 0 (zero) means the opposite. And each gate represents a different traffic cop opinion about what conditions must exist before electricity can be allowed to pass through. Chart B spells out those conditions.

## SOUND


The LSI chip generates the sounds you hear while you play the game. If it gets loose, the sound will flicker back and forth between normal and distorted. If it gets hot or goes bad, the sound will get distorted and stay that way.

The ROM chip contains the information the LSI chip uses to generate the particular sounds in D-Bug. If it gets hot or goes bad, there will be no sound at all. If it gets loose, the sound will flicker on and off.

Bonus: While you're in the Sound section, you can change the sounds in D-Bug if you want to. Just place your character over a note and press your joystick button.

## I/O (Input/Output)


The top LSI chip in this section is the "Floppy Disk Controller." It handles the communication between the disk drive and the computer, making sure that the two devices "understand" each other. The bottom LSI chip is the "Direct Memory Access" (DMA) interface. It lets the computer take information from the disk and put it directly into the computer's program memory. If either of these chips get loose or hot or go bad, a boot error results.


The right LSI chip (the video controller) controls the overall image you see on the TV monitor. If it gets hot or goes bad, you'll see a pinched screen instead of a normal sized one. If it gets loose, the screen will alternate back and forth between pinched and normal.

The left LSI chip (the character generator) generates the shapes in Gotcha! A problem here will cause the Gotcha! shapes to show up with missing parts. If it gets loose, the shapes will flicker back and forth between incomplete and normal. If it gets hot or goes bad the shapes will stay incomplete.

The information the left LSI uses to know what particular images to generate is stored in the ROM chip. If it gets hot or goes bad, no shapes will appear; the screen will show only a solid background color. If it gets loose, the shapes will flicker on and off.

Bonus: While you're in the Graphics section, you can change the shapes in the Gotcha! game. Just put your character over the new shape you want and press your joystick button. You won't be allowed to choose the shape your opponent is using.



D-Bug is a brand new kind of educational/recreational/informational resource for kids. Part cartoon, part book, but more than both because it invites and responds to the actions kids take when they use it, D-Bug offers more than a glimpse into how the computer can be used as a medium for teaching and learning how dynamic systems work.

While your children play D-Bug, they will learn the names of the principal sections and parts of computer systems and how they work together to enable the computer to do its work. They will also have the opportunity to practice – and enjoy using – the powerful skill of deductive reasoning through trial and error problem diagnosis, working from symptom to cause. This skill underlies nearly all creative scientific thinking.

## GLOSSARY

Boot – to activate the start-up process a computer goes through when first turned on (this term comes from "pulling himself up by the bootstraps").

Boot Error – a message seen when the computer fails to boot, typically caused by diskette or I/O problems.

Chip – a small piece of semiconductor material, like silicon, containing electrical circuits. It was the invention of integrated circuit chips that made the development of small, powerful computers possible. ENIAC, one of the first computers, contained vacuum tubes and filled a large room. By 1967, thanks to digital chips, there were hand-held programmable calculators on the market which were more powerful than ENIAC.

Dynamic garbage – meaningless graphics moving randomly around the screen.

Fuse – a device designed to protect electric equipment by failing and thereby shutting down the system before large power surges can do any other damage.

Garbage – meaningless graphics on the screen.

LSI (Large Scale Integration) – LSI chips contain up to 10,000 circuits in a space smaller than your little fingernail.

RAM (Random-Access Memory) – where the computer stores information temporarily. Unless it is first saved to disk, the information in RAM disappears when the computer is turned off. (The "random access" part of the name refers to the fact that all information in RAM can be gotten at directly without regard to the order in which it was stored.)

ROM (Read-Only Memory) – where important information (the BASIC language, perhaps, or the instructions that tell the computer how to boot up when the power is turned on) is stored permanently. The computer can read information from ROM but it cannot store information there. The information in ROM is built in when the chips are manufactured.

VLSI (Very Large Scale Integration) – VLSI chips contain more than 10,000 circuits, yet are physically no larger than LSI chips.

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